

CLAIMS

1. A dilating trocar for forming a passageway in a body cavity wall between a body cavity and surroundings by stretching a through primary opening in the body cavity wall to the size of a complete opening, comprising
 - * a cannula having a tubular passageway portion adapted to the location at the level of said complete opening and a proximally disposed housing,
 - * a dilating means designed for stretching said primary opening , and having:
 - ** a distal portion, which at least from the beginning to the completion of stretching said primary opening is located inside the body cavity,
 - ** a dilating portion of changeable geometry disposed adjacent to said distal portion proximally of it, distally of said passageway portion and having dilating surfaces,
 - ** a first position wherein said distal portion is located inside the body cavity, said dilating portion is placed into said primary opening so that at least by the beginning of stretching said primary opening the walls of said primary opening along its full length are disposed within the axial limits of said dilating portion, said dilating surfaces are faced the walls of said primary opening and the transversal dimensions of said dilating portion and distal portion measured at least in the same plane parallel to the longitudinal axis of said dilating trocar are considerably less than the outer diameter of said passageway portion to provide inserting said dilating portion into said primary opening with an insignificant resistance offered by the body tissues and without substantial stretching said primary opening,
 - ** a second position wherein said transversal dimensions of said dilating portion are effectively bigger than its correspondent dimensions in said first position, and the transition from said first position to said second position leads to stretching said primary opening to the size approximately equal to the size of said complete opening and sufficient for introducing therein said passageway portion,
 - ** an actuating means for transpositions of said dilating means from said first position to said second position.
2. The dilating trocar of claim 1, wherein said dilating means has at least one movable dilating member connected to a carrier at its distal end, there is a carrier housing at a proximal end of said carrier, and said actuating means is designed for forcing apart said dilating member resulting in a stretching movement of said dilating member and stretching said primary opening.

3. The dilating trocar of claim 2, wherein said movable dilating member is movable relative another dilating member and the movement of said dilating members relative to each other results in said primary opening stretching.
4. The dilating trocar of claim 3, wherein said actuating means includes an actuator mechanism located at said carrier and designed for the user's control of the transpositions of said dilating members, as well as a transmitting means for transmitting the control efforts from said actuator mechanism to said dilating members.
5. The dilating trocar of claim 4, wherein said actuator mechanism is made as an actuating member having an actuating handle and a movable thread connection with said carrier housing allowing axial displacement of said actuating member and carrier relative to each other, said transmitting means is made as a transmitting rod, and a distal end of said transmitting rod as well as the proximal ends of said dilating members are adapted for interacting with each other to force apart said dilating members and release them by axial transposition of said actuating member relative to said carrier.
6. The dilating trocar of claim 1, wherein there is a penetrating means for carrying out said primary opening, which in said first position protrudes distally of said distal portion of dilating means.
7. The dilating trocar of claim 6, wherein said penetrating means comprises a sharp element.
8. The dilating trocar of claim 7, wherein said penetrating means has a protecting means for the protection of said sharp element, including a shield and a biasing spring.
9. The dilating trocar of claim 6, wherein said penetrating means is based on said carrier.
10. The dilating trocar of claim 1, wherein said dilating portion comprises an axial passage, wherein a guide is housed during inserting said dilation portion into said primary opening.

11. The dilating trocar of claim 6, 10, wherein said guide is made as a removable obturator having an obturator handle disposed at said obturator proximal end and said penetrating means located at said obturator distal end.
12. The dilating trocar of claim 2, wherein said carrier is adapted for placement inside said cannula passageway portion and has a carrier attachment means allowing removable attaching said carrier to said cannula.
13. The dilating trocar of claim 12, wherein said carrier attachment means is made as a controllable latch mechanism allowing engagement/disengagement of said carrier and cannula housing.
14. The dilating trocar of claim 2, wherein said cannula fulfils the role of said carrier and said dilating members are connected to a distal end of said cannula passageway portion.
15. The dilating trocar of claim 2, wherein said at least one dilating member has a pivotal connection to said carrier and said actuating means is adapted for providing the pivotal movement of said at least one dilating member relative to said carrier.
16. The dilating trocar of claim 15, wherein said pivotal connection of said dilating member to said carrier is made as a flexible link connecting said dilating member to said carrier.
17. The dilating trocar of claim 15, wherein said pivotal connection of said dilating member to said carrier is made as a hinge connecting said dilating member to said carrier.
18. The dilating trocar of claim 12, wherein there is a reverting means designed for reverting said dilating members from said second position to said first position needed for removing said carrier along with said dilating members from said cannula after inserting said cannula into said complete opening in the body cavity wall.
19. The dilating trocar of claims 18, wherein the role of said reverting means fulfils a distal edge of said cannula, which forces said dilating members to revert to said first

position during removing said carrier from said cannula after previous removing said actuating means from the zone of contact with said dilating members.

20. The dilating trocar of claim 2, wherein, in said first position, said dilating surfaces of said dilating portion and a longitudinal trocar axis are substantially parallel to each other with the exception of certain small deviations from said parallelism needed for the auxiliary purposes.
21. The dilating trocar of claim 20, wherein said dilating member movement occurs mainly in the transversal direction with respect to the longitudinal axis of said dilating trocar with maintaining said parallelism of dilating surfaces and longitudinal axis of said dilating trocar.
22. The dilating trocar of claim 2, wherein said dilating means is provided with a sealing means preventing the substantial gas pressure drop in the body cavity as a result of gas leakage through movable joints or orifices of said dilating means.
23. The dilating trocar of claim 1, which is provided with a gas supply means designed for a gas supply into the body cavity before the commencement of said stretching said primary opening.
24. The dilating trocar of claim 1, wherein said dilating means has: said dilating portion including a balloon expandable in the transversal direction with respect to the longitudinal trocar axis; said actuating means made as a balloon actuating means designed for expanding said balloon from said first position to said second position by its filling with fluid after its introducing into said primary opening.
25. The dilating trocar of claim 24, wherein said balloon actuating means is made as a cylinder containing said fluid in the form of liquid, communicated with said balloon and having a plunger slidably housed inside said cylinder and adapted to forcing out said liquid from said cylinder into said balloon to expand it and to permitting said liquid to revert from said balloon again into said cylinder to collapse said balloon.
26. A dilating trocar for forming a passageway in a body cavity wall between a body cavity and surroundings by stretching a through primary opening in the body cavity wall to the size of a complete opening, comprising

- * a cannula having a tubular passageway portion adapted to the location at the level of said complete opening and a proximally disposed housing,
- * a penetrating means for forming said primary opening,
- * a dilating means designed for stretching said primary opening, and having:
 - ** a distal portion, which at least from the beginning to the completion of said primary opening stretching is located inside the body cavity,
 - ** a dilating portion of changeable geometry disposed adjacent to said distal portion proximally of it and distally of said passageway portion, and
 - *** having dilating surfaces whose length is not less than the thickness of the body cavity wall,
- ** a first position wherein said distal portion is located inside the body cavity, said dilating portion is placed into said primary opening so that at least by the beginning of stretching said primary opening the walls of said primary opening along its full length are disposed within the axial limits of said dilating portion, said penetrating means protrudes distally of said distal portion, said dilating surfaces are faced the walls of said primary opening, and the transversal dimensions of said dilating portion and distal portion measured at least in the same plane parallel to the longitudinal axis of said dilating trocar are considerably less than the outer diameter of said passageway portion to provide inserting said dilating portion into said primary opening with an insignificant resistance offered by a body tissues and without substantial stretching said primary opening, while said cannula passageway portion is located beyond the body cavity wall above it,
- ** a second position, obtained only after said first position, wherein said transversal dimensions of said dilating portion are effectively bigger than its correspondent dimensions in said first position, and the transition from said first position to said second position leads to stretching said primary opening approximately to the size of said complete opening sufficient for introducing therein said passageway portion,
- *** actuating means for transpositions of said dilating means from said first position to said second position.

27. The dilating trocar of claim 26, wherein said penetrating means is disposed on an obturator removably housed inside an axial passageway in said dilating portion.

28. The dilating trocar of claim 27, wherein said penetrating means has a sharp element.

29. A method for forming a passageway in a body cavity wall between a body cavity and surroundings performed by a dilating trocar set comprising: a cannula with a housing and a tubular passageway portion; a penetrating means, a dilating means comprising an actuating means, a distal portion, and a dilating portion having an extendable transversal dimensions, protruding distally of said cannula passageway portion, a guide for inserting said dilating portion into said primary opening, therewith in the initial state a cross-sectional area within the limits of an overall outer contour of said dilating and distal portions along their full length is considerably less than one of said cannula passageway portion, said method, comprising:
- * performing a through relative small primary opening in the body cavity wall by said penetrating means so that, in the following, the dimensions of said primary opening allows inserting therein said dilating portion with insignificant resistance offered by the body tissue and without substantial stretching said primary opening,
 - * inserting said dilating portion into said primary opening by means of said guide so that said distal portion is located within the body cavity, while said cannula passageway tubular portion is located beyond the body cavity wall above it,
 - * extending said extendable transversal dimensions of said dilating portion in the transversal direction by said actuating means, thereby stretching said primary opening to a complete opening sufficient for inserting therein said cannula passageway portion,
 - * inserting said cannula passageway portion into said complete opening,
 - * final operations including removing at least said actuating means from an interior of said cannula.
30. The method of claim 29, performed by said dilating trocar set wherein an inflation of the body cavity by gas is carried out after said inserting said dilating portion and before said extending transversal dimensions of dilating portion.
31. The method of claim 29, wherein an introducing said guide into said primary opening is performed after said performing said primary opening and before inserting said dilating portion.
32. The method of claim 29, performed by said dilating trocar set wherein said dilating portion includes at least two dilating members pivotably connected to a carrier at its distal end, and said actuating means includes an actuating member having an actuating handle, controllable by user, and a movable thread connection with said

carrier, as well as a transmitting rod interacting with said dilating members, said method, wherein:

- * said extending said extendable transversal dimension of dilating portion in the transversal direction by actuating means is accomplished by forcing apart said dilating members as a result of axial displacing said actuating member and transmitting rod relative to said carrier and interacting said transmitting rod with said dilating members,
- * said inserting said cannula passageway portion into complete opening at least partly is accomplished during said forcing apart said dilating members.

33. The method of claim 29, performed by said dilating trocar set wherein said guide is made as a removable obturator having an obturator handle and said penetrating means, which partly protrudes distally of said distal portion and comprises a sharp member, a protective shield and a biasing spring, said method, wherein said performing a through relative small primary opening in the body cavity wall is accomplished by said penetrating means of obturator and after entering the body cavity said sharp element is protected by said protective shield.
35. The method of claims 31, 33, wherein said introducing said guide into primary opening and said inserting said dilating portion into primary opening by means of said guide are accomplished as a single operation.
36. The method of claim 33, wherein after said inserting said dilating portion and before said extending dimensions of dilating portion, a full removing said obturator from said dilating trocar and then an introducing said actuating means into said dilating trocar are carried out.
37. The method of claim 32, performed by said dilating trocar set wherein said carrier is disposed on the inside of said cannula passageway portion, said method, wherein said final operations include also removing said carrier along with said dilating member from said cannula.
38. The method of claim 29, performed by said dilating trocar set wherein said dilating portion includes a balloon expandable in the transversal direction and an actuating means in the form of the system for controllable fluid supply into said balloon, said method, wherein:

- * said extending said extendable transversal dimension of said dilating portion is accomplished by supplying a pressurized fluid into said balloon leading to expanding said balloon and stretching said primary opening to said complete opening,
- * said final operations include at least partial removing said fluid from said balloon and removing it from said cannula.